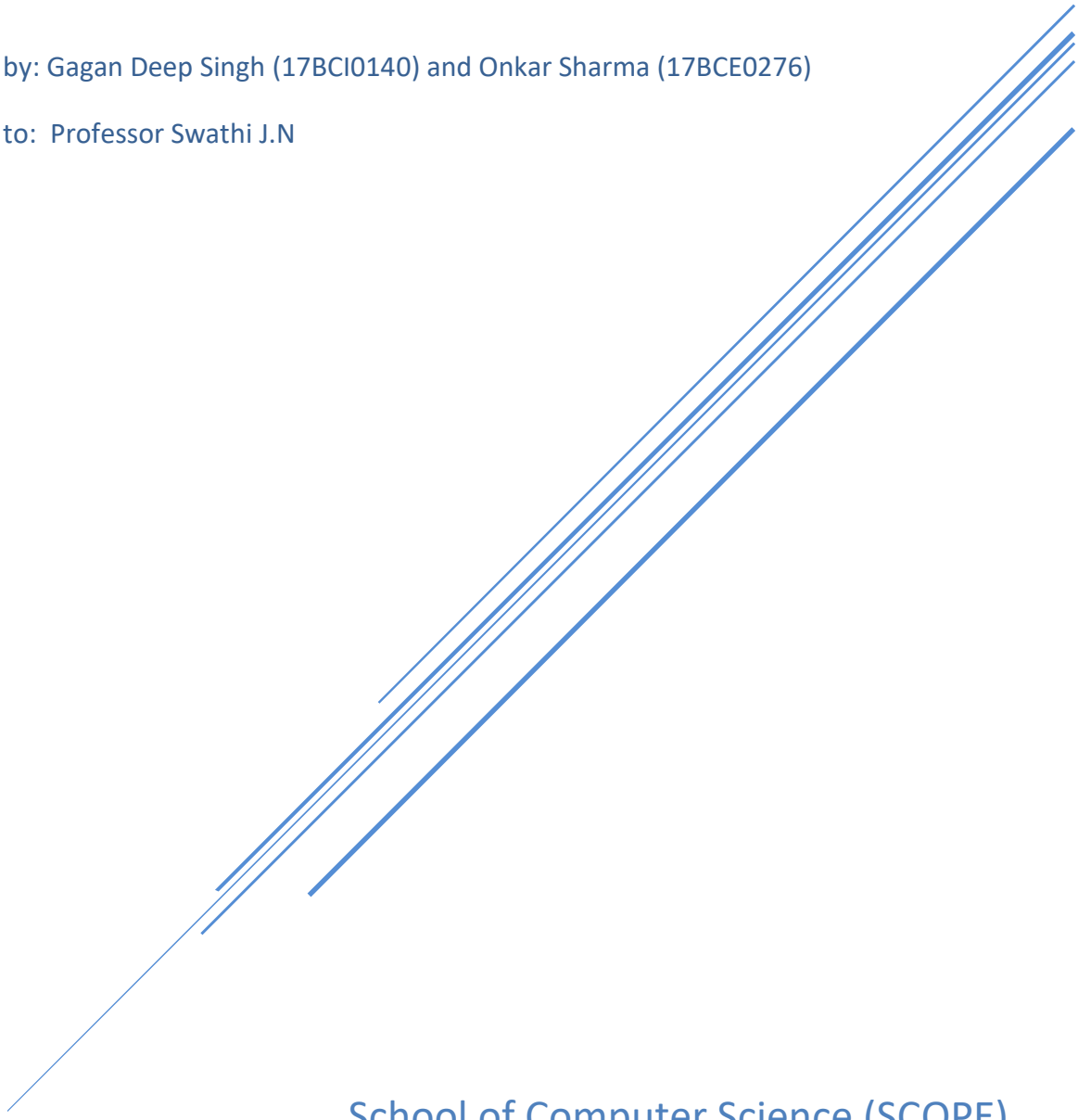
WEATHER FORECASTING SOFTWARE

Software Engineering Project

Submitted by: Gagan Deep Singh (17BCI0140) and Onkar Sharma (17BCE0276)

Submitted to: Professor Swathi J.N



School of Computer Science (SCOPE)
Vellore Institute of Technology

Deceleration by the students….

We **Onkar Sharma, Gagan Deep Singh** are the members of the group who made this project Titled **"Weather Forecasting Software"** under the supervision of our course instructor **Professor SWATHI J.N – SCOPE department**.

Only we, the members of the group, are responsible for the content of this project report, and we will take full responsibility of any plagiarism issues in the report. We will also make sure the contents of the report will not be used by any other student in Vellore Institution of Technology, Vellore or outside.

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Introduction:

Theoretical background:

This project is particular to data analysis, analyzing weather data like temperature, humidity and wind to predict the state of the atmosphere for a given location. This is basically achieved by observing patterns in events (patterns recognition). A **graphical user interface** is provided to users (including administrator), along with user ID and password. User (casual or end users) will enter current temperature, humidity and wind (Direction and speed), system will take these parameters and with the help of previous data in database, will predict weather for next day or later in that day. Current data entered by user if available will be stored in database (Data collection), to improve future predictions. Only system administrator has the authorization to add or remove data strictly based on standard criteria. System administrator can also modify data only in case of data entered in correctly and is essential to the system, otherwise incorrect data can only be deleted. The system has basically only these two types of users.

Motivation:

Modern weather forecasting involves a combination of computer models, observation, and a knowledge of trends and patterns. Using these methods, reasonably accurate forecasts can be made up to about **five days** in advance. Beyond that, detailed forecasts are less useful, since atmospheric conditions such as temperature and wind direction are very complex. **So, will you need your snow boots tomorrow? Should you bring an umbrella?** Accurate weather predictions are important for planning our day-to-day activities. Farmers need information to help them plan for the planting and harvesting of their crops. Airlines need to know about local weather conditions in order to schedule flights. Weather forecasting helps us to make more informed daily decisions, and may even help keep us out of danger.

Aim of the proposed work:

Aim of this project is applications in fields of agriculture, forestry and general predictions for citizens. As this project' predictions are based only on limited parameters and omitted infeasible computation for regular computer systems, the software can be proved unreliable for military, navy, Air Traffic Control and marine applications. But will have the provision to advance to such applications.

Objectives of the proposed work:

Objective of this project is to deliver a working software that can predict weather parameters for up to 5 days. Further, for meaningful completion of this project we have our objective to provide other functionalities stated in Software Requirement Specification document. All functionality should work efficiently and have expected outcome.

Literature Survey:

Survey of the Existing Models/Work:

Digital Atmosphere is a powerful Windows software package that allows you to plot detailed surface and upper air maps, soundings, and radar charts anywhere in the world. This software program has been under development since 1992 and is used by hundreds of hobbyists, companies, and weather agencies. Check out some websites with Digital Atmosphere in action: Australian Weather News, Mateo Center Russia, and Weather Roanoke. It also produces publication-quality images and has been used in Weather wise magazine since 2001.

WX-SIM is a dynamic forecast model operating at one location, forecasting the weather for that spot. WX-SIM exploits observed conditions and centralized forecast data from **NOAA** and combines it with its own sophisticated physics model of the local atmosphere. The result? A singularly accurate forecast for the location of your choice. This makes it the tool of choice for the agricultural industry, aviation forecasters, and sporting venues.

Summary/Gaps identified in the Survey:

All the professional weather forecasting software are too complicated and costly for general public seeking general weather features. They also provide graphical methods to plot and visualize data which remain unused except for research. Our aim is to provide a software that is simple and convenient for user to use and provide only useful information.

Proposed System Requirements Analysis and Design:

Introduction:

Requirement Analysis:

Functional Requirements:

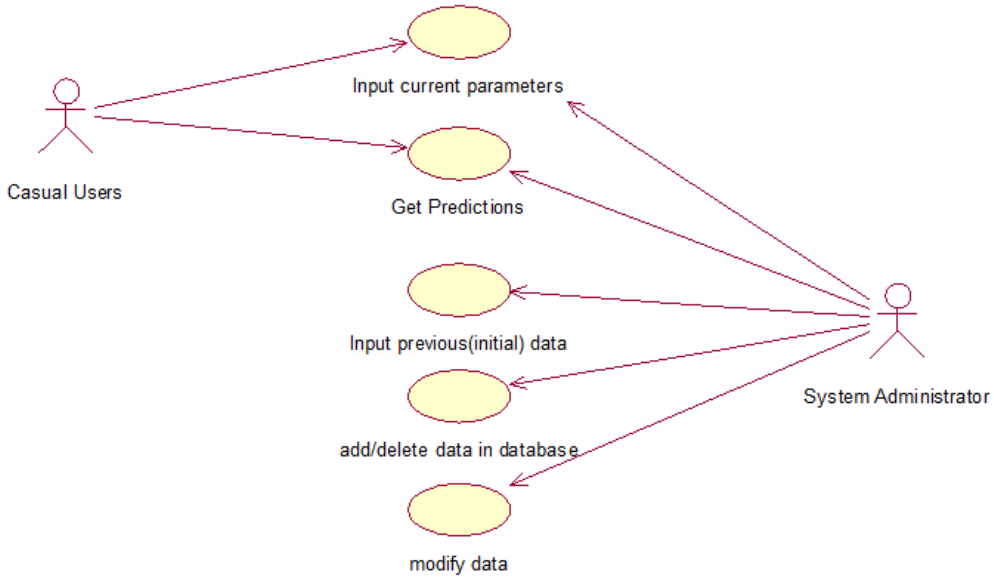
Product Perspective

The project is mainly about large amounts of data that is generated by various systems in today's world and convert it to useful information for a variety of users. The Software collects weather data, such as temperature, humidity, wind speed, and various other parameters, from different sources and display as well as predict the environmental conditions of a particular location in the near future depending on the user (causal users who may use the software for general information). Recent weather patterns are analyzed to make a prediction. A user interface is provided for the users, along with the administrator. Authorization is done using a user ID and password. The users are also able to enter the current data if it is available with them. This is just to get a better idea of the real time conditions of that particular place. This data will be verified by tallying it against other sources and then added to the database. Also, the administrator can insert, modify or remove data manually from the database if there are inconsistencies along with the ability to block certain users.

Product features

This project will display predictions on weather at a particular location, selected by user. The data will be verified for its correctness. System administrator will be provided provision to add/ extend data to data based and also to modify or remove certain data. Applications of this project are in fields of agriculture, forestry and general predictions for citizens.

The use case diagram of the software is shown below.



User characteristics

The following table identifies and describes the different users of the weather forecasting software. The information gathered about the different users of the system helped define what the software needs to do. Also, these users are referenced in the requirements and diagrams.

Table of User Characteristics

User	**Description**
Causal users	The user is anyone who is using the system for general prediction of weather data at a particular location. He has a small role in adding small piece of data to the database after verification by the concerned administrator.
Administrator	The Administrator user will be computer literate and technically competent in performing administration on computer systems.

Assumption & Dependencies

The following table lists the assumptions made by the requirements that define the weather forecasting software.

Assumption	Description
Hardware quality.	One assumption about the product is that it will always be implemented and used on hardware devices that is the weather measuring instruments that have good performance.

As data is collected from an online website, there is not much hardware or software dependencies. Internet connectivity should be present at the time of prediction.

Non-Functional Requirements:

System Requirements:

Reliability

Reliability in the Weather forecasting software will be ensured by thorough unit, milestone, and release testing. Comprehensive test scenarios and acceptance criteria will be established to reflect the necessary level reliability required of the Weather forecasting software. The all delivered source code will be thoroughly tested using the established test scenarios until the acceptance criteria are satisfied by the Weather forecasting software.

Security

To store sensitive information in database the software will use hashing techniques and various encryption algorithms. Verification and authentication of user and administrator will be done thorough secured channel and anonymity will be maintained.

Easy to use

Training time to use the Weather forecasting software is in 2 to 3 days that include learning al details of the software use. This time period is reasonable. However, this does not include learning internal mathematical and statistical calculations.

Speed

The speed or number of processed transactions per second of the weather forecasting software is also reasonable, but also machine dependent. Screen refresh time is also monitored and efforts are in reducing this time thereby increasing the speed.

Others

i. Secure access of confidential data (user's details). SSL or Hashing can be used.

ii. 24 X 7 availability

iii. Better component design to get better performance at peak time

iv. Flexible service-based architecture will be highly desirable for future extension

Design of the Proposed System:

Introduction:

High level Design:

System Architecture

The system architecture chosen for the weather forecasting software is Repository Model. As large amount of data is needed to change. The advantages of this model are that it need not to consider how data is produced and sharing model is published as repository schema. Here subsystems agree upon repository model.

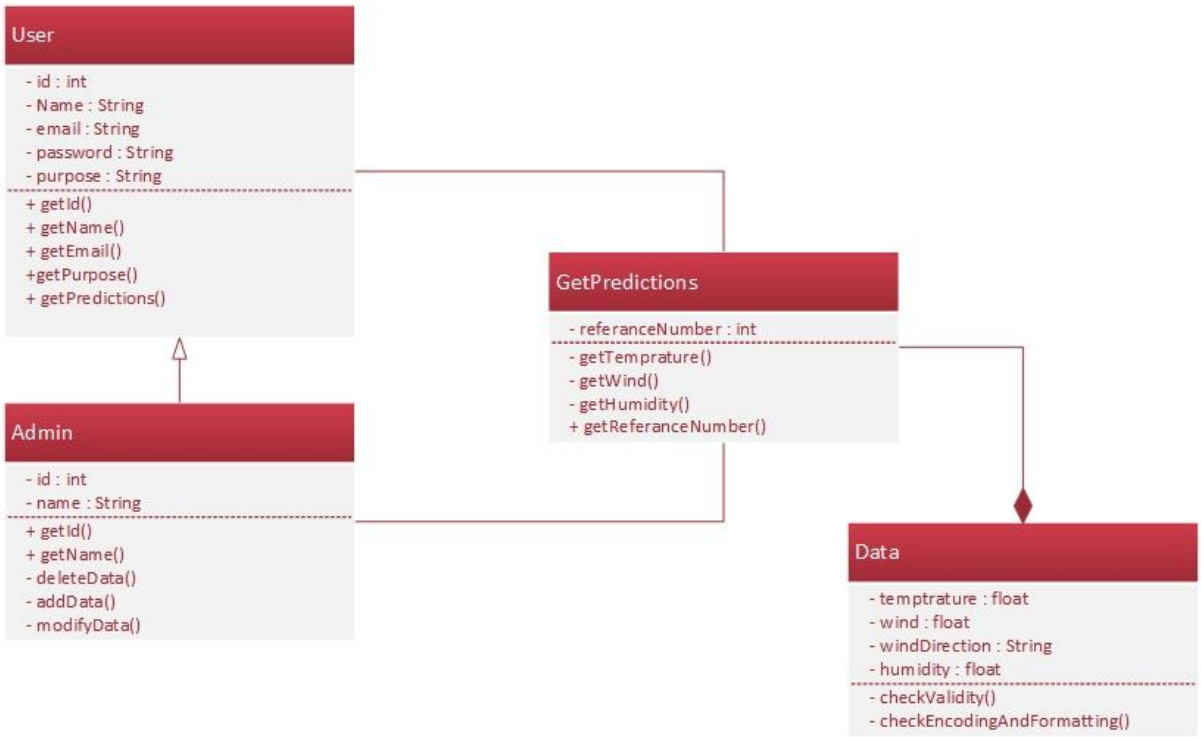
Control Model

We will be using the Call and Return model which comes in the centralized control model. One subsystem is designated as the controller which manages the execution of the other subsystems. The execution is sequential. The main subsystem calls a subsystem to perform a function and after execution the control is returned to the main subsystem.

This is the best-suited model for our project because, it is a small-scale project which does not require large functionalities. So, sequential execution will give the best performance.

Detailed Design:

UML Class Diagram:



Admin Class:

The Admin class is capable of adding or removing data from the database. If some conditions satisfy then the admin can also modify data. This class responsible for managing the data. The admin class is also the user having many of the mentioned privileges, this shows the polymorphism character of the admin class.

User Class:

The user class can access general specified methods of GetPredictions class which let the user to view certain set of the data. User also has some role in modifying the database by just adding small amount of data available to him/her.

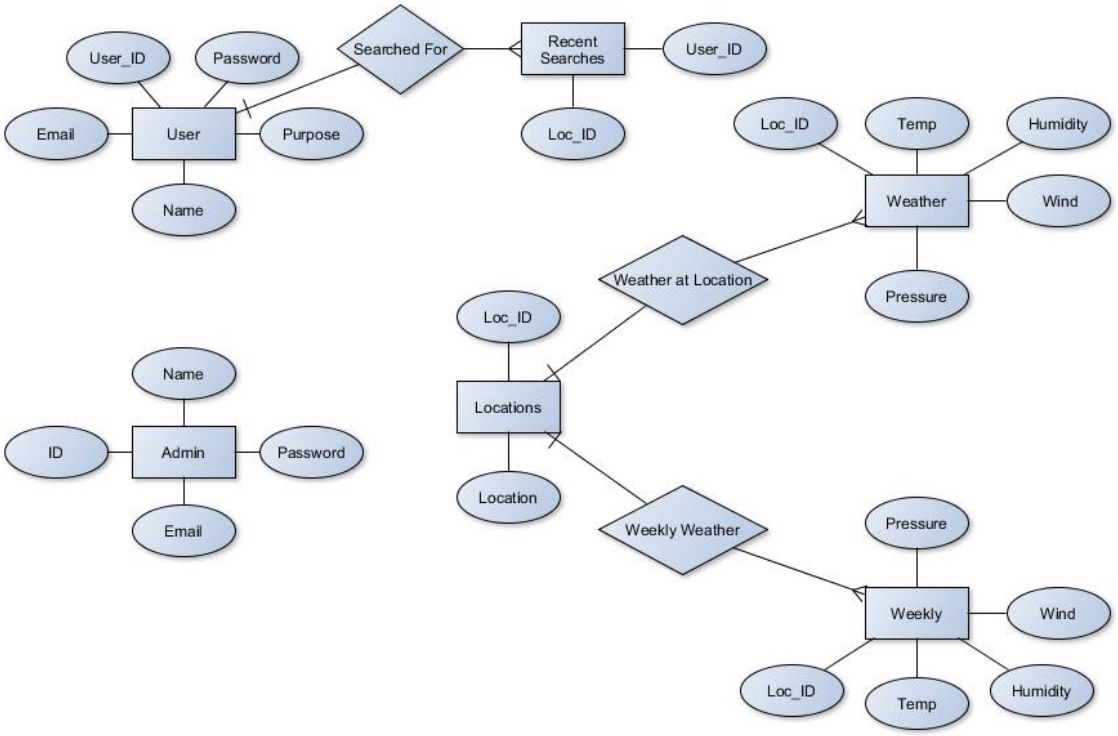
GetPredictions Class:

This class has access to all the weather data which is used to get general predictions. This class has most of attributes private so as to maintain the security of the system as anyone can extend this class.

Data Class:

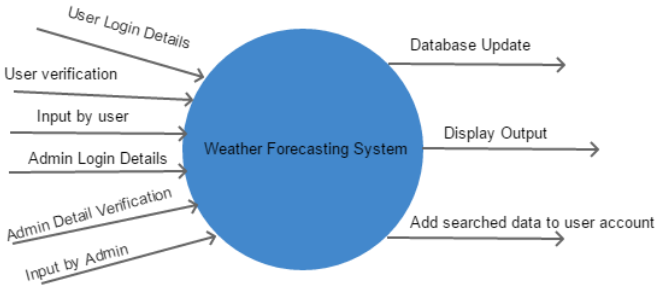
This class maintain the general data of the users, admin and the data required for weather predictions. This class has role in admin and user verification and in checking correctness of predictions.

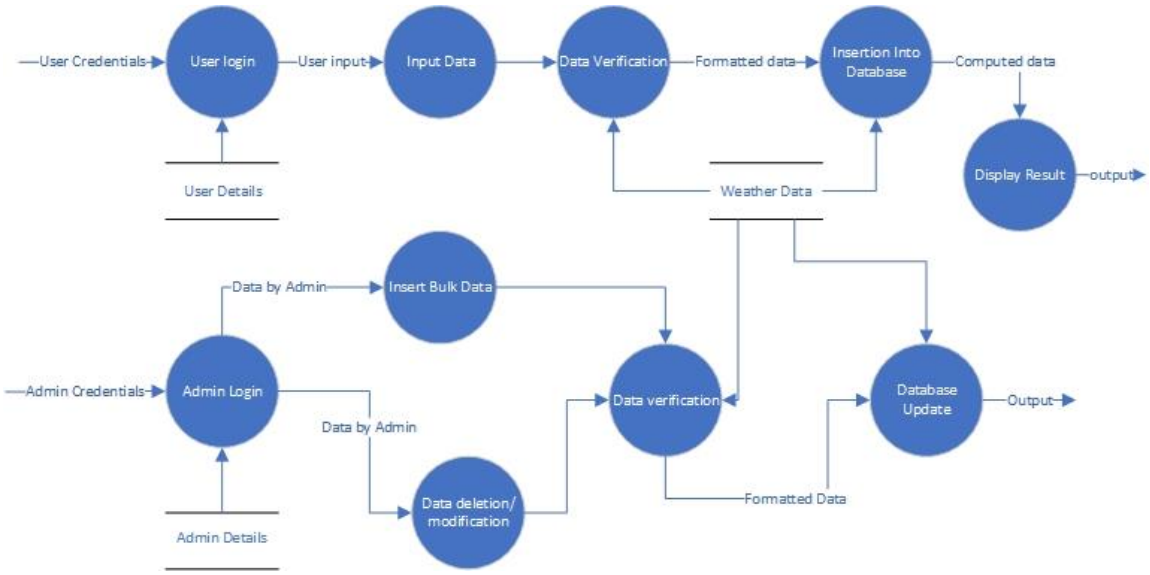
ER Diagram:



Data flow diagram:

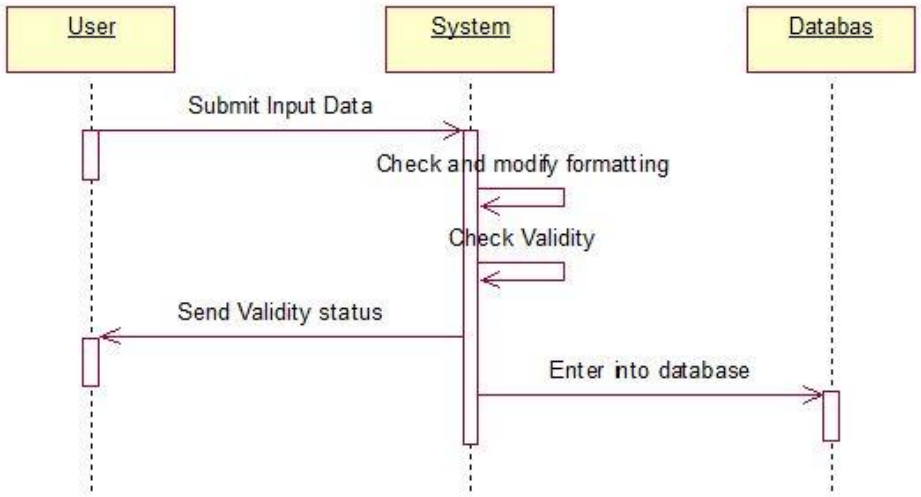
The following figures represent the data flow diagrams of the weather forecasting software. The first data flow diagram, figure 2, is the top-level data flow. This is followed by the more detail data flow of the Software.



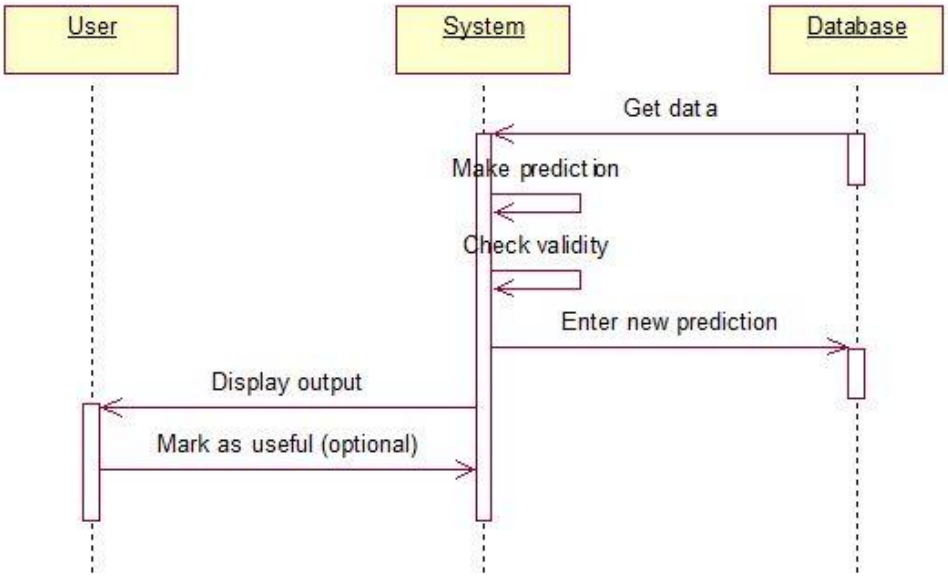


Sequence Diagram:

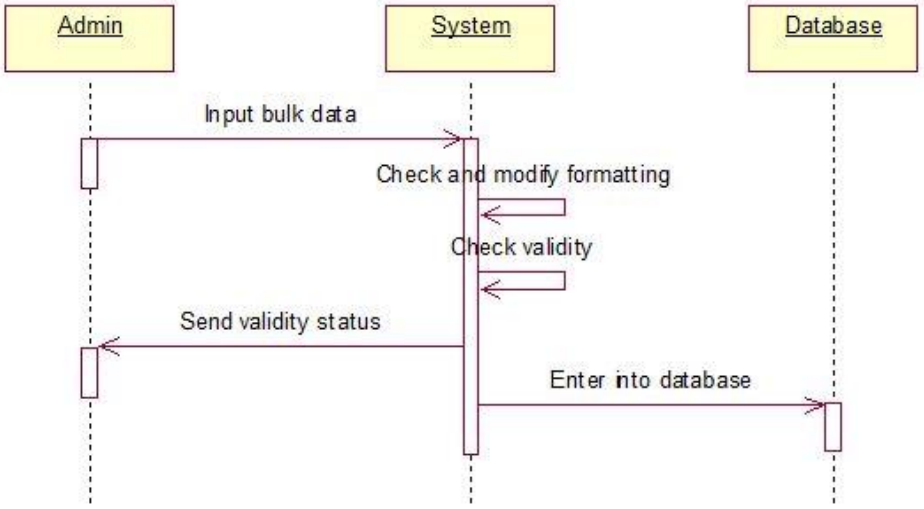
Input Current Parameters:



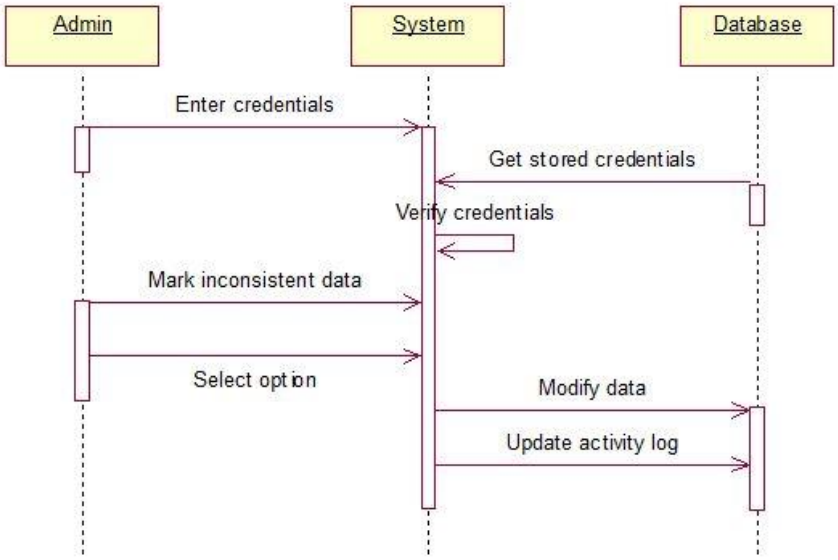
Get Predictions:



Input Bulk Data:

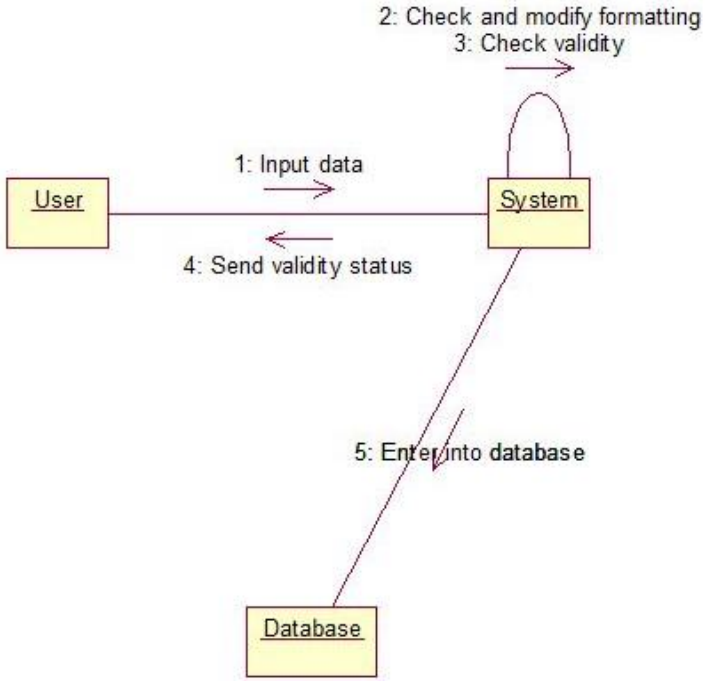


Add/Delete/Modify Data:

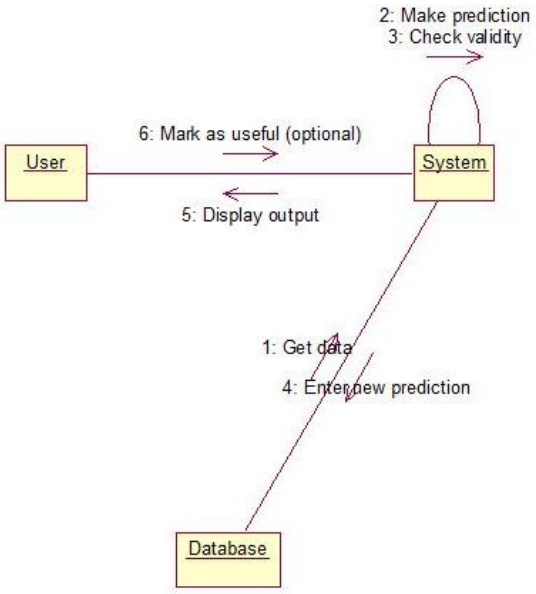


Collaboration diagram:

Input Current Parameters:



Get Predictions:



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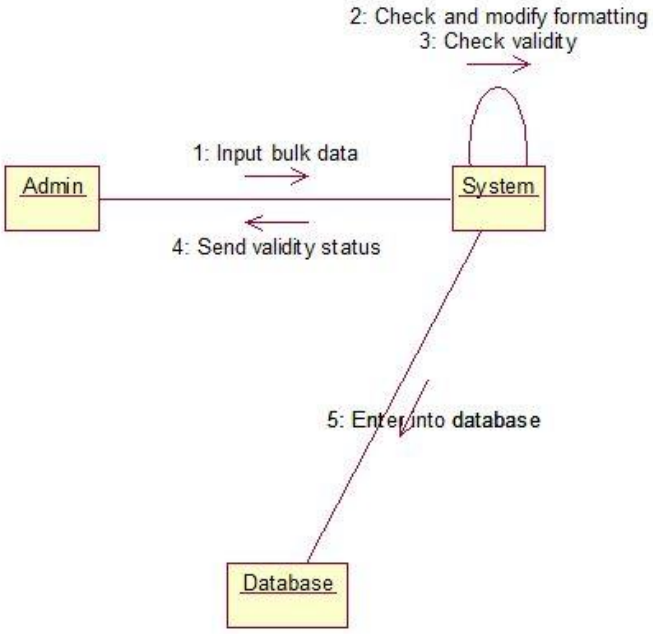
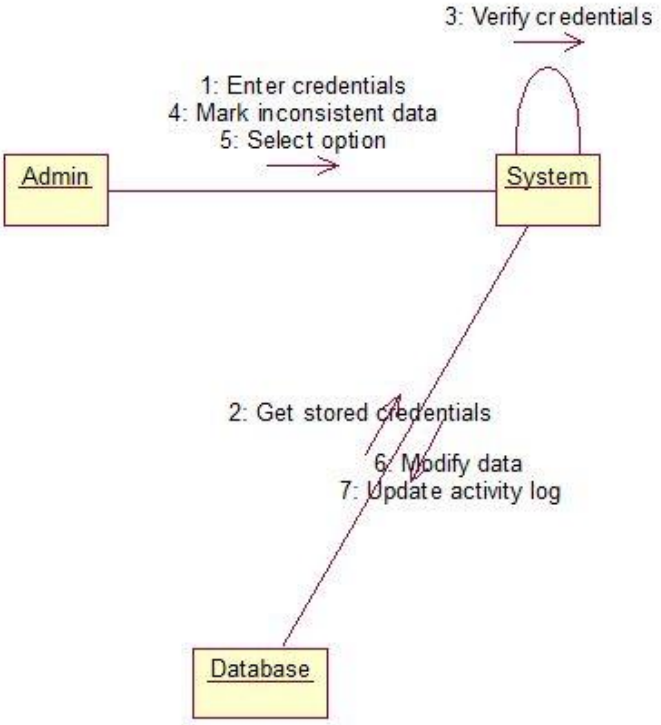
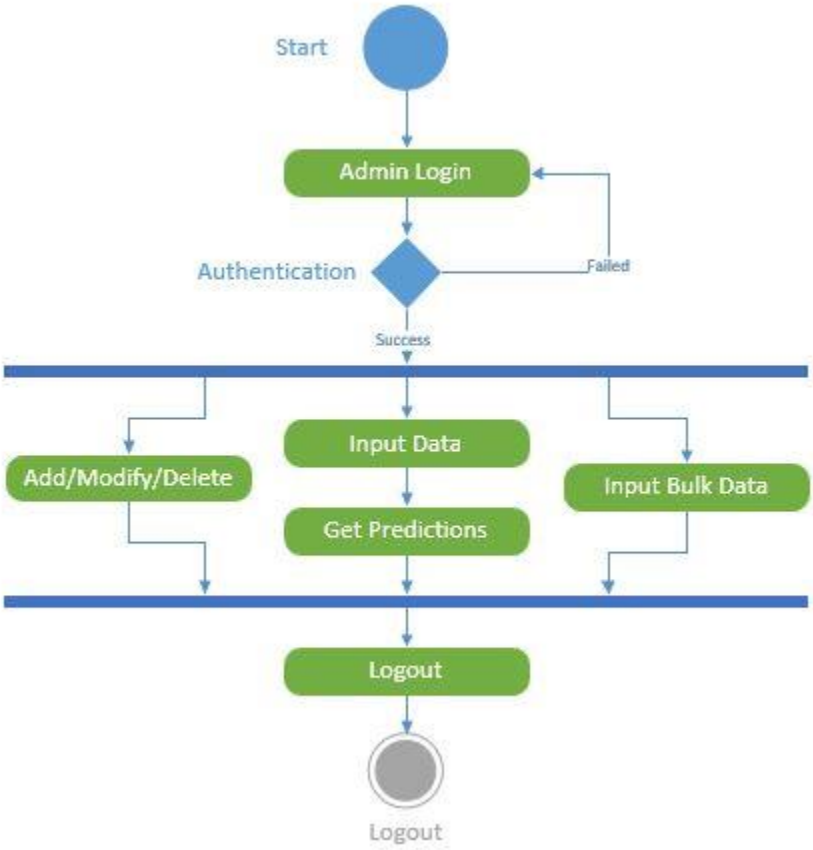


Add/Delete/Modify Data:

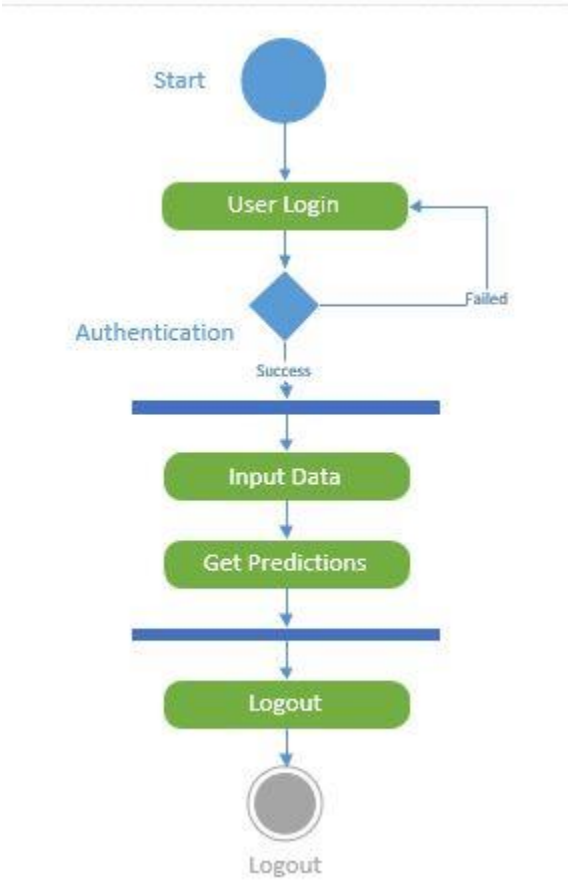


Activity diagram:

Admin:



User:

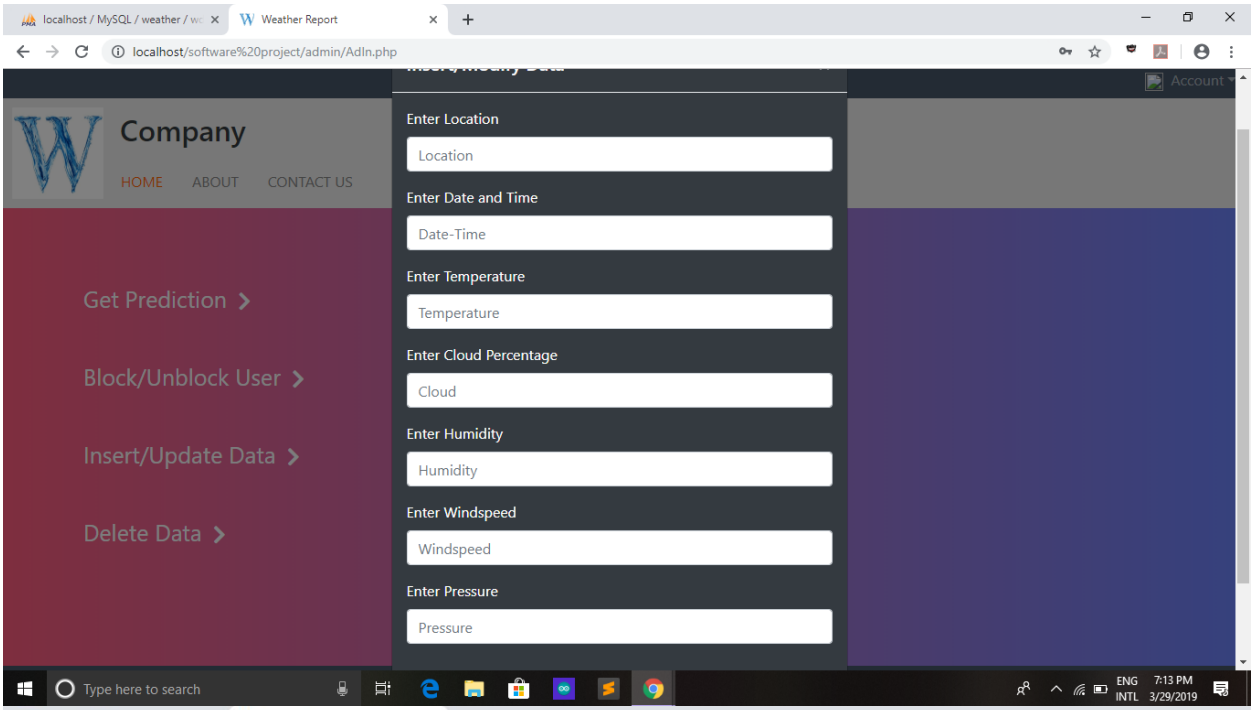

Start
User Login
Failed
Authentication
Success
Input Data
Get Predictions
Logout
Logout

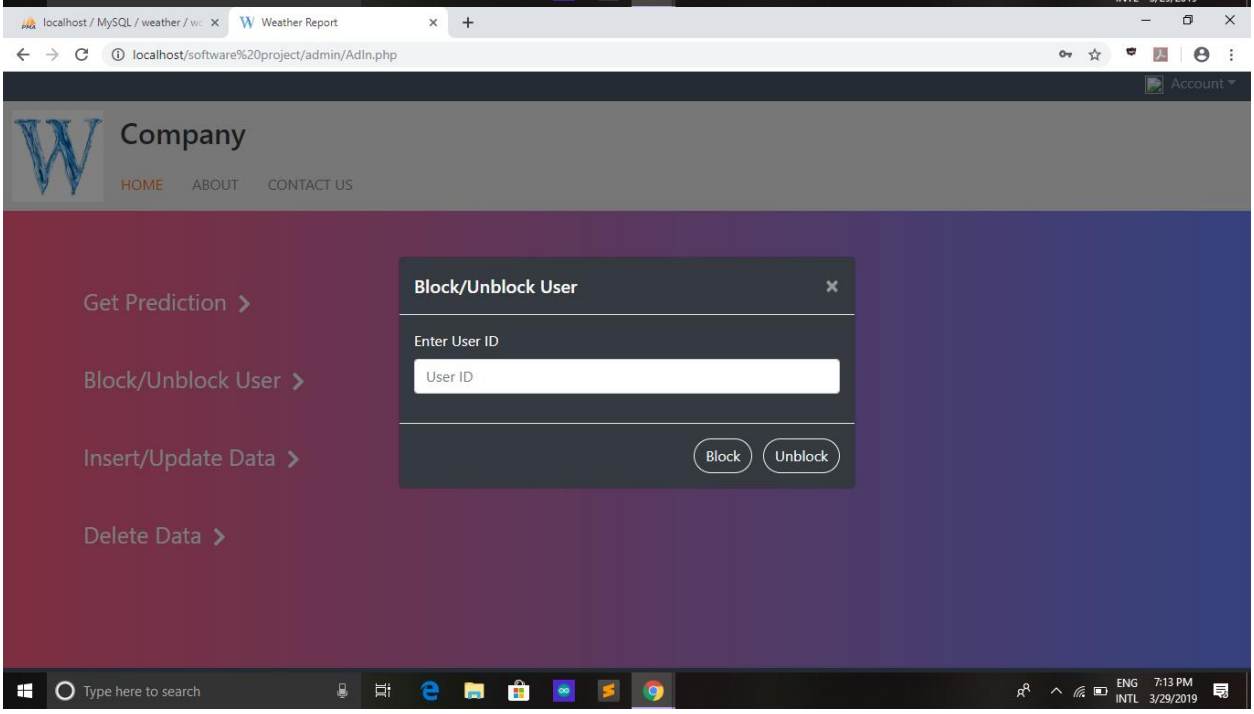
Implementation and Testing:

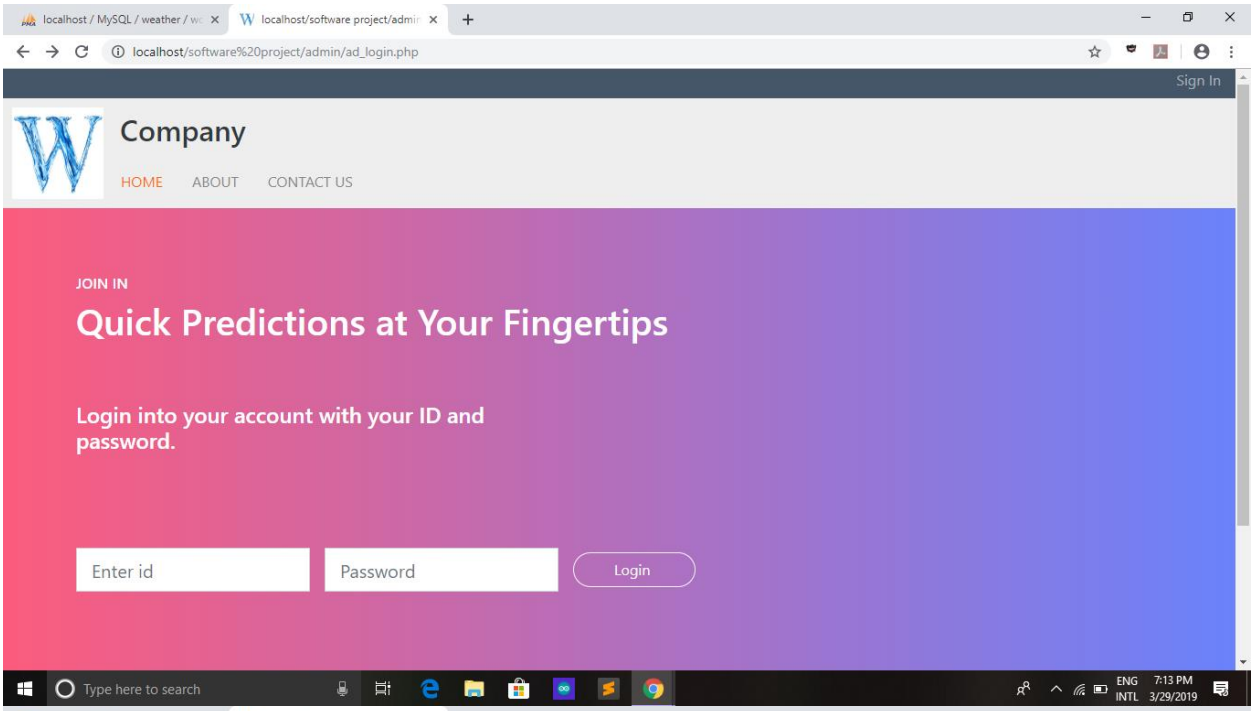
Test Case ID	Test Objective	Test Data	Expected Results	Actual Results	Test Pass/Fail
001	To test working of main landing page.	URL of the landing page hosted on computer's loopback address. url: localhost/software project/	Landing page is expected to work with proper styling and format.	Landing page is working as expected with proper styling and format.	Pass
002	To test user signup process.	Name, user ID, email, password, purpose. Name: Gagandeep Singh, User ID: gagandeep1, Email: gagandeep@mail.com, Password: qazmlp, Purpose: General weather prediction.	Signup process complete successfully, Login page should appear with success message.	Signup process complete successfully, Login page appears with success message.	Pass
003	To test user login process.	User ID and Password User ID: gagandeep1 Password: qazmlp	User dashboard should appear.	User Dashboard appears.	Pass
004	To test user settings	New username, email or profile picture.	Username, email and profile picture should be updated.	Username, email and profile picture are updated.	Pass
005	To test user logout process.	Click on account in top right corner and then logout.	User logs out and homepage should appear.	User logs out and homepage appears.	Pass
006	To test predictions	Select date along with time from dropdown menu in dashboard.	Predictions related to temperature, pressure, humidity, and wind speed should display.	Temperature, pressure, humidity, and wind speed predictions appears.	Pass
007	To test is predictions are requested without selecting the date and time.	Click on get predictions in dashboard.	Error message should come and date and	Error message appears.	Pass

			time should be requested.		
008	To test is predictions are requested without providing location	Click on get predictions in dashboard without selecting locations.	Error message should appear, asking for location.	Error message appears asking for location.	Pass
009	To test contact-us link.	Click on the link at the bottom of the page.	Company details should display along with Email IDs of developers. A feedback form should.	Company details get displayed along with Email IDs of developers. A feedback form appears.	Pass
010	To test feedback form.	Fill in the questions asked in form.	Success message should display stating thanks for cooperation.	Success message appears stating thanks.	Pass
011	To test get predictions process by admin.	Location, date and time.	System should work as worked for user.	Weather data gets displayed as for the user.	Pass
012	To test admin manual addition of data.	New data, related to temperature, pressure, humidity and wind speed.	New data should be added to database.	New data gets added in database.	Pass
013	To test deletion/modification of data	Input date and time for which data has to be deleted and modified.	Change should appear in database.	Database gets updated.	Pass
014	To test admin login process.	Enter admin ID and password. Admin ID: Password:	Admin should able to login, and see his dashboard.	Admin login appears.	Pass
015	To test admin block user process.	User ID of user whom admin has a suspicion upon.	User gets blocked.	User ID no longer able to login.	Pass

Implementation and Testing Screenshots:



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Sign In
Company
HOME
ABOUT
CONTACT US
JOIN IN
Quick Predictions at Your Fingertips
Login into your account with your ID and password.
Enter id
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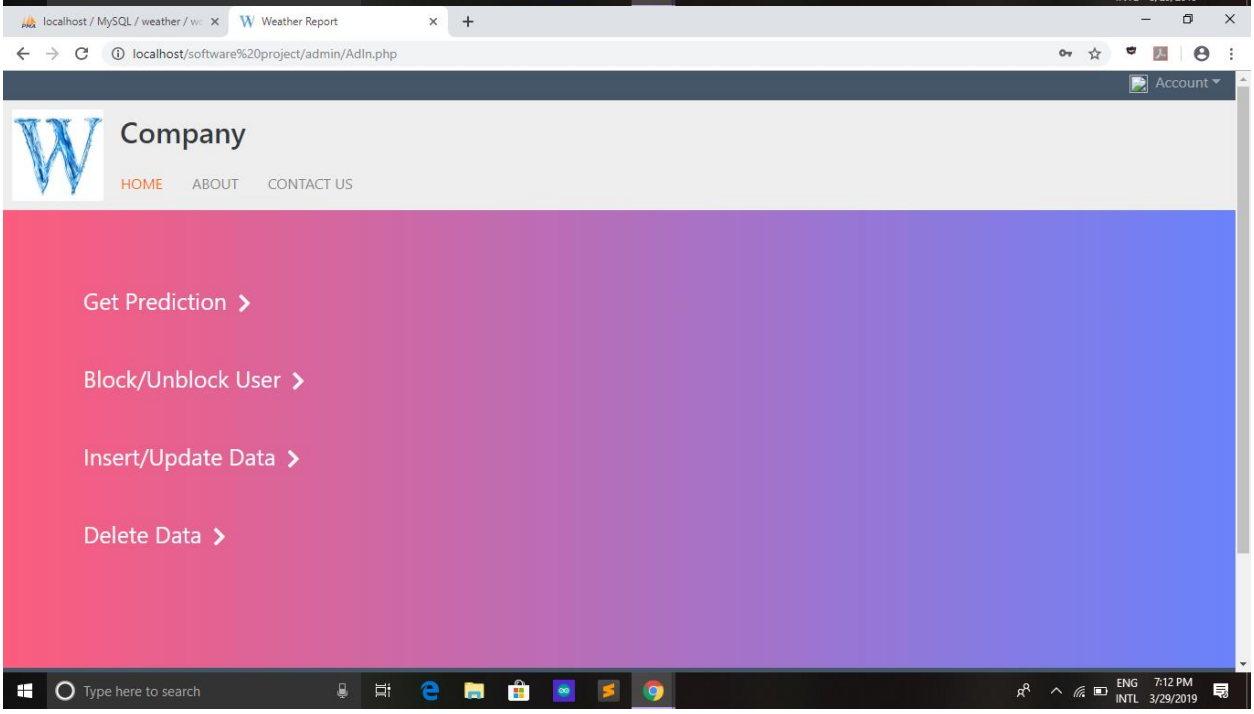
3/29/2019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HOME
ABOUT
CONTACT US
Get Prediction
Block/Unblock User
Insert/Update Data
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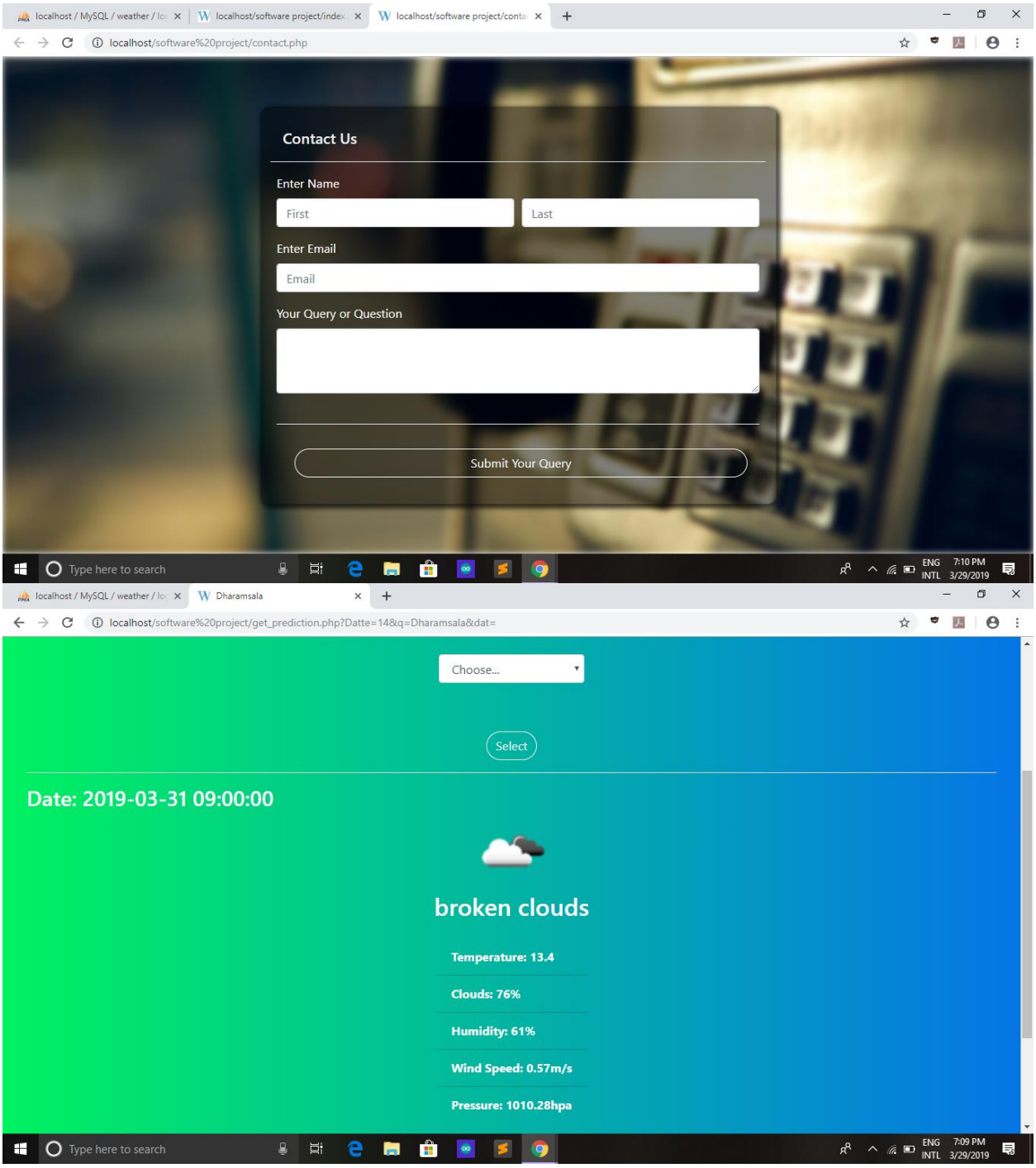
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Contact Us
Enter Name
First
Last
Enter Email
Email
Your Query or Question
Submit Your Query
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3/29/2019
localhost / MySQL / weather / Ic
Dharamsala
localhost/software%20project/get_prediction.php?Datte=14&q=Dharamsala&dat=
Choose...
Select
Date: 2019-03-31 09:00:00
broken clouds
Temperature: 13.4
Clouds: 76%
Humidity: 61%
Wind Speed: 0.57m/s
Pressure: 1010.28hpa
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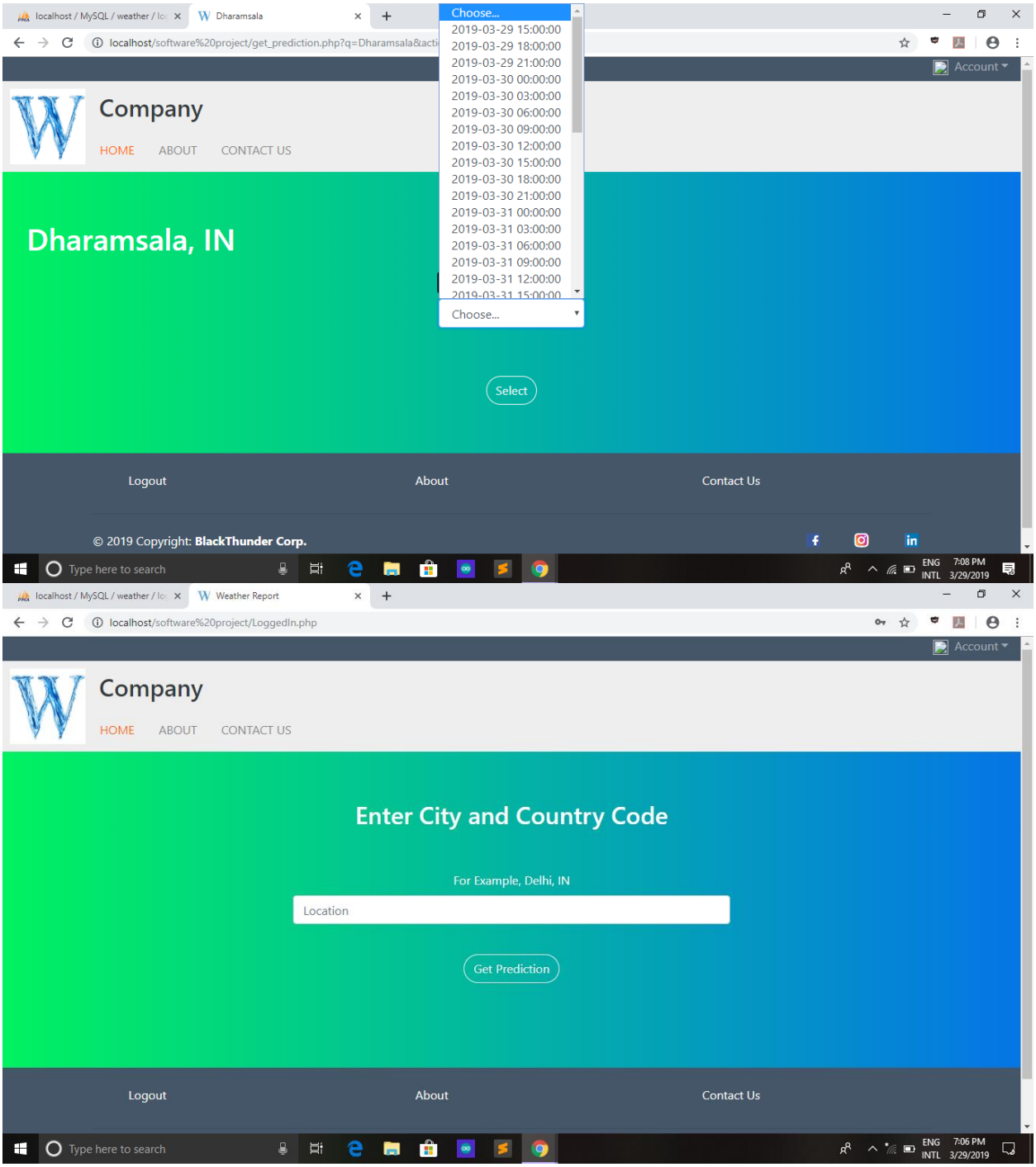
Dharamsala
Company
HOME
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CONTACT US
Account
Dharamsala, IN
Choose...
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2019-03-29 21:00:00
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2019-03-30 03:00:00
2019-03-30 06:00:00
2019-03-30 09:00:00
2019-03-30 12:00:00
2019-03-30 15:00:00
2019-03-30 18:00:00
2019-03-30 21:00:00
2019-03-31 00:00:00
2019-03-31 03:00:00
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2019-03-31 09:00:00
2019-03-31 12:00:00
Choose...
Select
Logout
About
Contact Us
© 2019 Copyright: BlackThunder Corp.
Type here to search
ENG
INTL
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3/29/2019
Weather Report
localhost/software%20project/LoggedIn.php
Company
HOME
ABOUT
CONTACT US
Account
Enter City and Country Code
For Example, Delhi, IN
Location
Get Prediction
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About
Contact Us
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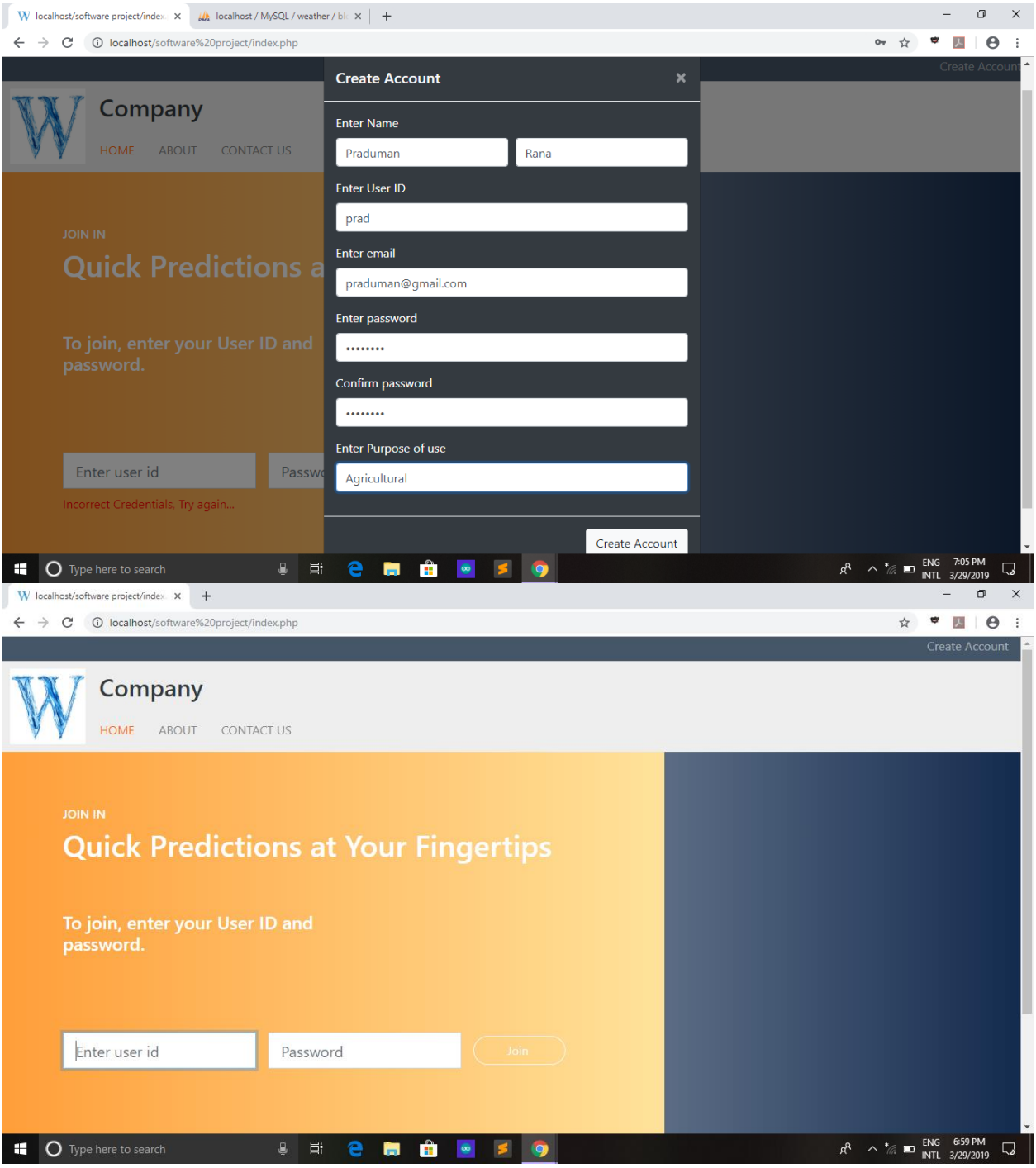
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localhost / MySQL / weather / bl
localhost/software%20project/index.php
Create Account
Company
HOME
ABOUT
CONTACT US
JOIN IN
Quick Predictions a
To join, enter your User ID and password.
Enter user id
Passw
Incorrect Credentials, Try again...
Create Account
Enter Name
Praduman
Rana
Enter User ID
prad
Enter email
praduman@gmail.com
Enter password
Confirm password
Enter Purpose of use
Agricultural
Create Account
Type here to search
ENG
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7:05 PM
3/29/2019
localhost/software project/index
localhost/software%20project/index.php
Create Account
Company
HOME
ABOUT
CONTACT US
JOIN IN
Quick Predictions at Your Fingertips
To join, enter your User ID and password.
Enter user id
Password
Join
Type here to search
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Conclusion, Limitations and Scope for future Work:

Conclusion

The overall conclusion of the project is that we were successful in delivering a weather forecasting software that tells general weather predictions regarding the simple weather parameters like temperature, pressure, humidity, wind direction and speed. This software (website) is simple to use and understand for general public.

Limitations

As mentioned before, it is not within the scope of this project to consider complex weather phenomenon or parameters to provide accurate information that can be trusted for military purposes. It is also not considered to provide user any graphical representation or enable user to express data graphically as most other modern software. Selection process for software administrator is also not taken into account carefully. The administrator has the power to block users and alter data which make this position a trusted one and must be chosen carefully.

Performance related limitations include the use of structured query language database and framework issues. These do not affect performance and compromise security much but it is not the best what can be done.

Future scope

For the further development of the project we would like to improve performance and security by implementing the idea in modern languages like python and database in NO-SQL or in Django framework. We would also like to take into consideration the complex parameters and phenomenon to improve predictions. The future scope of this project is general civilian use and with the help of future development we can improve it to agricultural use in India.

References:

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https://github.com/yashvardhan-kukreja/WeatherWear (Third year VIT student)

https://openweathermap.org/api

http://forecast.is/ru/saint-petersburg/sankt-peterburg/536203/

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https://creately.com/diagram/example/idl7vnhw1/Weather%20forecasting%20system

Software Engineering a practitioner's approach by Roger S Pressman for theoretical notes.

Class notes provided by Professor Swathi J.N (Instructor)